

What is claimed is:

1. A process for performing high tibial osteotomy surgical operations on portions of a tibia, comprising:

(a) obtaining at least one image of a body part forming a portion of a knee joint with an imager, wherein the body part and the imager are each attached to a fiducial capable of being tracked by at least one position sensor;

(b) registering a surgical instrument adapted to assist the surgeon in shaping bone during high tibial osteotomy, which instrument is attached to a fiducial capable of being tracked by at least one position sensor;

(c) using a computer which receives signals from the at least one sensor, tracking position and orientation of the surgical instrument relative to the body part;

(d) generating and displaying on a monitor associated with the computer a visual image of the instrument properly positioned and oriented relative to the body part;

(e) navigating the surgical instrument relative to the body part and attaching the surgical instrument to the body part according to the image; and

(f) modifying the body part using the surgical instrument attached to the body part; and

(g) assessing performance of the knee joint using images displayed on said monitor.

2. The process of claim 1, further comprising registering a body part by intraoperatively designating at least one point on the body part with a probe, wherein the probe is attached to a fiducial capable of being tracked by said at least one position sensor.

3. The process of claim 1, wherein the body part comprises one of a femur and a tibia.

4. The process of claim 1, wherein the imager comprises one of a C-arm fluoroscope, a CT scanner, and an MRI machine.

5. The process of claim 1, wherein the fiducials comprise one of active fiducials, passive fiducials and hybrid active/passive fiducials.

6. The process of claim 1, wherein the position tracking sensors comprise one of infrared sensors, electromagnetic sensors, electrostatic sensors, light sensors, sound sensors, and radiofrequency sensors.

7. The process of claim 1, wherein the surgical instrument comprises a pivot pin and a cutting jig.

8. The process of claim 1, further comprising:

- (a) discontinuing tracking of the surgical instrument using the fiducial attached to a drill sleeve; and
- (b) initiating tracking of the surgical instrument using the fiducial attached to the body part on which the surgical instrument is installed.

9. The process of claim 1, further comprising:

- (a) performing soft tissue balancing tests while the computer continues to track the fiducials;
- (b) using data generated by the computer to assess alignment and stability of the surgical instrument and the knee joint; and
- (c) changing the angle of the surgical instrument to adjust alignment and stability of the knee joint.

10. A process for performing high tibial osteotomy surgical operations on portions of a tibia comprising:

- (a) obtaining at least one image of a body part forming a portion of a knee joint with an imager, wherein the body part and the imager are each attached to a fiducial capable of being tracked by at least one position sensor;

- (b) registering a surgical instrument adapted to assist the surgeon in shaping bone during high tibial osteotomy, which instrument is attached to a fiducial capable of being tracked by at least one position sensor;
- (c) using a computer which receives signals from the at least one sensor, tracking position and orientation of the surgical instrument relative to the body part;
- (d) generating and displaying on a monitor associated with the computer a visual image of the instrument properly positioned and oriented relative to the body part;
- (e) navigating the instrument relative to the body part and attaching the instrument to the body part according to the image;
- (f) discontinuing tracking of the instrument using the fiducial attached to the instrument;
- (g) initiating tracking of the instrument using the fiducial attached to the body part on which the instrument is installed;
- (h) generating and displaying on the monitor a visual image of the instrument properly positioned and oriented relative to the body part;
- (i) modifying the body part using the instrument attached to the body part; and
- (j) assessing performance of the knee joint using images displayed on said monitor.

11. A process for performing high tibial osteotomy surgical operations on portions of a tibia comprising:

- (a) obtaining at least one image of a body part forming a portion of a knee joint with an imager, wherein the body part and the imager are each attached to a fiducial capable of being tracked by at least one position sensor;
- (b) registering a surgical instrument adapted to assist the surgeon in shaping bone during high tibial osteotomy, which instrument is attached to a fiducial capable of being tracked by at least one position sensor;

(c) using a computer which receives signals from the at least one sensor, tracking position and orientation of the instrument relative to the body part;

(d) generating and displaying on a monitor associated with the computer a visual image of the instrument properly positioned and oriented relative to the body part;

(e) navigating the instrument relative to the body part and attaching the instrument to the body part according to the image;

(f) discontinuing tracking of the instrument using the fiducial attached to the instrument;

(g) initiating tracking of the instrument using the fiducial attached to the body part on which the instrument is installed;

(h) generating and displaying on the monitor a visual image of the instrument properly positioned and oriented relative to the body part;

(i) performing soft tissue balancing tests while the computer continues to track the fiducials;

(j) using data generated by the computer to assess alignment and stability of the knee joint with the surgical instrument attached; and

(k) changing the angle of the surgical instrument to adjust alignment and stability.

(l) modifying the body part using the instrument attached to the body part; and

(m) assessing performance of the knee joint using images displayed on said monitor.

12. A system for performing high tibial osteotomy surgical operations on portions of a tibia comprising:

(a) an imager for obtaining an image of a tibia, wherein the imager and the tibia are each attached to a fiducial capable of being tracked by a position sensor;

(b) at least one position sensor adapted to track position of said fiducials;

(c) a computer adapted to store at least one image of the tibia and to receive information from said at least one sensor in order to track position and orientation of said fiducials and thus the tibia;

(d) a pivot pin adapted to be attached to a tibia using a drill sleeve in a high tibial osteotomy procedure, said drill sleeve attached to a fiducial, whereby the position of the pivot pin is capable of being tracked by said sensor and the position and orientation of the pin is capable of being tracked by said computer; and

(e) a monitor adapted to receive information from the computer in order to display at least one image of said pivot positioned and oriented relative to the tibia for navigation and positioning of the pin in the tibia.

13. A system for performing high tibial osteotomy surgical operations on portions of a tibia comprising:

(a) an imager for obtaining an image of a tibia, wherein the imager and the tibia are each attached to a fiducial capable of being tracked by a position sensor;

(b) at least one position sensor adapted to track position of said fiducials;

(c) a computer adapted to store at least one image of the tibia and to receive information from said at least one sensor in order to track position and orientation of said fiducials and thus the tibia;

(d) a cutting jig adapted to be positioned over a pivot pin in a high tibial osteotomy procedure, whereby the position of the cutting jig is capable of being tracked by said computer according to the position and orientation of the pivot pin; and

(e) a monitor adapted to receive information from the computer in order to display at least one image of said cutting jig positioned and oriented relative to the tibia for navigation and positioning of the cutting jig on the tibia.

14. A system for performing high tibial osteotomy surgical operations on portions of a tibia comprising:

(a) an imager for obtaining an image of a tibia, wherein the imager and the tibia are each attached to a fiducial capable of being tracked by a position sensor;

(b) at least one position sensor adapted to track position of said fiducials;

(c) a computer adapted to store at least one image of the tibia and to receive information from said at least one sensor in order to track position and orientation of said fiducials and thus the tibia;

(d) a pivot pin adapted to be attached to a tibia using a drill sleeve in a high tibial osteotomy procedure, said drill sleeve attached to a fiducial, whereby the position of the pivot pin is capable of being tracked by said sensor and the position and orientation of the pin is capable of being tracked by said computer;

(e) a cutting jig adapted to be positioned over a pivot pin, whereby the position of the cutting jig is capable of being tracked by said computer according to the position and orientation of the pivot pin; and

(f) a monitor adapted to receive information from the computer in order to display at least one image of at least one of said pivot pin and cutting jig, positioned and oriented relative to the tibia for navigation and positioning of the pin and the cutting jig on the tibia.